Assessing Both Solution Diversity and Solution Quality in Constraint Programming

Thierry Petit, Andrew C. Trapp

Assessing Both Solution Diversity and Solution Quality in Constraint Programming

Thierry Petit and Andrew C. Trapp

Techniques for solving optimization problems naturally prioritize the value of an objective function, typically producing a single solution. While this is essential from the optimality point of view, there are scenarios where it may be advantageous to consider multiple solutions, as distinct as possible from one another. Unfortunately, constraint-based techniques that can be used to generate diverse solutions are designed for satisfaction problems. They do not assess objective quality. In this work, we tackle this issue with a generic paradigm for assessing both solution diversity and solution quality, that can be implemented in most existing solvers. As there is no requirement for the initial solution to be optimal, there is therefore no theoretical restriction on solving large problems, using for instance Large Neighborhood Search. We show that our technique can be specialized to produce diverse solutions of high quality in the context of over-constrained problems. Furthermore, our paradigm allows us to consider diversity from a different point of view, based on generic concepts expressed by global constraints. Our experiments yield encouraging computational results.